Claims

1. Built-up multiple cam for a camshaft, comprising

- a first partial cam (1) having a bore (12), a cam contour A (4) and a joint contour (7) which is disposed axially adjacent thereto and comprises an outer surface (7a),
- a second partial cam (2) having a bore (12), a cam contour A (5) and a joint contour (8) which is disposed axially adjacent thereto and comprises an outer surface (8a),
- a ring (3) having a cam contour B (6), which is different from the cam contour A, and an inner contour (9) which comprises an inner surface (9a), wherein the ring (3) can be slid with its inner surface (9a) on to the outer surfaces (7a, 8a) of the partial cams (1, 2),
- and connection means which are effective between the ring (3) and the partial cams (1, 2) and ensure a firm connection between these components.

2. Built-up multiple cam as claimed in claim 1, characterised in that the inner contour (9) of the ring (3) and the joint contours (7, 8) of the partial cams (1, 2) are non-circular.

3. Built-up multiple cam as claimed in claim 1 or 2, characterised in that the connection means which are effective between the ring (3) and the partial cams (1, 2) are formed as an interference fit and/or form-fit.

4. Built-up multiple cam as claimed in claim 1 to 3, characterised in that on at least one of the two partial cams (1, 2) in the region of the transition from the joint contour (7, 8) to the cam contour (4, 5) there is disposed a shoulder (13) which protrudes in a radial direction beyond the outer surface (7a, 8a) of the partial cam (1, 2).

5. Built-up multiple cam as claimed in claim 4, characterised in that the shoulder (13) is formed in one piece with the partial cam (1, 2) e.g. as a radius or chamfer.

6. Built-up multiple cam as claimed in any one of the preceding claims, characterised in that the axial extension of the ring (3) is greater than the sum of the axial extensions of the joint contours (7, 8).

7. Built-up multiple cam as claimed in any one of the preceding claims, characterised in that the outer surfaces (7a, 8a) are provided with engraving which has been applied e.g. by roller-burnishing or by knurling.

8. Built-up multiple cam as claimed in any one of the preceding claims, characterised in that the inner ring surface (9a) comprises engraving or an axially extending toothing arrangement.

9. Built-up multiple cam as claimed in any one of the preceding claims, characterised in that the inner contour (9) of the ring (3) comprises a radial widened portion on its axial end regions.

10. Built-up multiple cam as claimed in any one of the preceding claims, characterised in that in at least one end region of at least one of the partial cams (1, 2), the bore (12) comprises an inner contour (12a, 12b) which is widened in a funnel-like manner with respect to the bore (12).

11. Built-up camshaft having at least one multiple cam as claimed in any one of claims 1 to 10.

12. Method of producing built-up camshafts having at least one multiple cam (15) as claimed in any one of claims 1 to 10, characterised by the method steps of:
a) Assembling the multiple cam (preassembly);
b) Sliding the preassembled multiple cam on to a support shaft (10) up to a predetermined portion (14) of the support shaft (10);
c) Fixing the multiple cam in an axial and torsion-resistant manner on this predetermined portion (14) of the support roller (10).

13. Method of producing built-up camshafts having at least one multiple cam (15) as claimed in any one of claims 1 to 10, characterised by the method steps of:

a) Providing a support shaft (10) which comprises at least one portion (14) which has been surface-finished by roller-burnishing or by knurling such that it comprises a larger outer diameter than the portions of the support shaft (10) which have not been machined,
b) Sliding the first partial cam (1), the ring (3) and the second partial cam (2) on to a portion of the support shaft (10) whose outer diameter has not been increased by roller-burnishing or by knurling and which adjoins the surface-finished portion (14), wherein the sliding-on procedure is performed in such a manner that the joint contours (7, 8) of the partial cams (1, 2) face towards the ring (3) and the desired angular position of the partial cams (1, 2) and of the ring (3) with respect to the support shaft (10) is adjusted,
c) Pressing-on the first partial cam (1), the ring (3) and the second partial cam (2) by sliding these components together on to the surface-finished portion (14) of the support shaft (10), wherein the ring (3) slides with its inner surface (9a) over the outer surfaces (7a, 8a) of the partial cams (1, 2), so that the multiple cam is formed and is fixed with a force-fit and/or form-fit in an axial and torsion-resistant manner at the designated position (portion (14)).

14. Method of producing built-up cam shafts which comprise a support shaft (10), e.g. a tube or a bar, having at least one multiple cam (15) as claimed in any one of claims 1 to 10, having at least three cam contours which are disposed axially adjacent to each other, characterised in that, in each case alternately until the required number of cam contours is achieved:

- initially a first partial cam (1) comprising a cam contour,
- followed by a ring (3) comprising a cam contour and
- then a further partial cam (2) comprising a cam contour

are slid over the support shaft (10) and are then attached to the support shaft (10) in an axial and torsion-resistant manner at the predetermined axial location with predetermined radial angles in order to form the multiple cam (15).

15. Method of producing built-up camshafts as claimed in claim 12 or 14, characterised in that in order to attach at least one of the partial cams (1, 2) a welding beam (X), e.g. a laser or electron beam is guided through the partial cam (1, 2) radially at the axial position, at which the ring (3) is spaced apart with a gap (16) from the partial cam (1, 2) which is to be welded, and therefore the partial cam (1, 2) is welded to at least certain points of the support shaft (10).